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ABSTRACT

Arguing that educators have evolved past the introductory computer literacy stage and now need an enhanced understanding of the uses of the computer as an essential tool of the trade, this paper identifies three factors that need to be considered when designing staff development programs: (1) a review of different cognitive abilities and skills required of students and how they are affected by high technology; (2) the recommendations of major educational studies and reports; and (3) the specific computer utilization skills needed to properly equip our teachers to be effective and efficient instructors. Ways in which computers can be used to improve students' critical thinking skills are considered from the perspective of Bloom's Taxonomy of Cognitive Domain, and the needs that should be met by a good computer utilization program are discussed in terms of the recommendations of the National Task Force on Educational Technology, the Holmes Group Report, and the Carnegie Report (1986). An outline of 15 skills needed in the computer age are suggested as a model to be customized according to local needs and resources, ranging from use of the computer as a tool, through various types of computer software, to classroom applications and peripheral technology. Tips for developing effective programs are also provided, as well as brief descriptions of the successful use of word processing in remedial writing classes in New Jersey. The need for ongoing support services to extend the training into actual implementation is noted, and several possible ways of providing such services are suggested. (EW)

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Computer Utilization Training in Staff Development

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COMPUTER UTILIZATION TRAINING IN STAFF DEVELOPMENT

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One of the leading concerns in education today is the need for staff development as a means to improve our educational system. Concurrently, our society is moving rapidly towards the implementation of high technology to improve the efficiency and effectiveness in handling vast amounts of information. As educators, we have evolved past the introductory computer literacy stage, and now need an enhanced understanding of the uses of the computer as an essential tool of the trade.

When designing staff development programs, there are three aspects that need to be considered: first, a review of different cognitive abilities and skills required of students in learning, and how they are affected by high technology; second, the recommendations of major educational studies and reports; and third, what computer utilization skills are needed to properly equip our teachers to be effective and efficient in the instructional process.

As educators explore methods to improve students' critical thinking skills, the use of the computer should be considered from the perspective of Bloom's Taxonomy of the Cognitive Domain. The computer can perform many lower level thought processes, leaving us more time and energy to use the

computer as a tool in the application of higher order thought processes.

The use of the computer in word processing can improve students' critical thinking skills while improving their writing skills. By taking out the drudgery and repetition of making revisions by rewriting, a student can replace such lower level efforts with higher level skills of evaluating their work and making corrections, refinements, and enhancements. Being able to relocate blocks of text allows students to rearrange their text, evaluate the change, and then decide which sequence to accept to best express their thoughts. Spelling checkers can identify words not in their word banks and force the user make decisions about spelling. We are asking the student to make decisions; in addition to, and in place of, just the memorization of spelling. Access to large data bases and direct retrieval into word processors can improve the quality of research and the development of ideas. The very nature of word processing facilitates students' use of more higher level cognitive behaviors to improve their writing and thinking skills.

Numerous knowledge and recall skills are affected greatly by the use of the computer. The use of data bases, with the efficient storage and retrieval of facts and figures, decreases our reliance upon memorization, freeing us to use higher levels of thought processing. "List", "name", and "write" become our commands to the computer, not our

actual processing. The process of finding relevant information from a data base requires the analysis of the problem, the creation of a search strategy, and the execution of a plan, while following the rules set up by the data base package. Such retrieval of facts "forces" analysis and synthesis while providing the organized, relevant data to evaluate and to make conclusions and decisions. Creating a data base involves developing an organizational design of the data to facilicate the future retrieval of pertinent information and report generation. These data base management techniques and procedures lead to the use of higher cognitive behaviors than just memorization and recall.

The use of spreadsheets allows the user to see data organized, calculated, and composed in a manner that lends itself to analysis and evaluation. The lower level skill of calculation is removed from the user by the higher level skills incorporated in the creation of the spreadsheet. The "what-if" feature of a spreadsheet leads to prediction, evaluation, conclusion, and support. A spreadsheet represents the creation of a model that provides well organized facts for analysis and evaluation.

The levels of thought processing referred to as application, analysis, and synthesis become necessary to use the computer as a problem-solving tool. Bloom refers to applications as the "use of abstractions in particular and

concrete situations." We are referring to computer utilization skills as applying the use of the computer to specific tasks that we perform in the educational arena. Bloom's description of analysis as " the breakdown of the material into constituent parts and the detection of the relationship of the parts and the way they are organized" is indicative of the uses of data bases and spreadsheets. Being able to display the same data in a variety of report formats helps students see relationships between fields and records. Similarly, the "what if" function of spreadsheets also helps discovery of relationships among the various components of the data structure. In his explanation of synthesis, Bloom states " it should be emphasized that this is not completely free creative expression since generally the student is expected to work within the limits set..." This is the same as a programmer constrained by the syntax of a particular language and hardware and the user of application software constrained by the mechanics of the particular application software program. Through the use of the computer, one can now make evaluations that are based on more facts; facts that are more easily organized and categorized.

Although Bloom's work was not geared specifically for computer utilization, his concepts clearly point out many of the attributes involved in use of the computer. Using the

computer as a tool allows its skillful user the opportunity to delegate some of the lower level cognitive tasks, allowing the user to become a better problem solver. The efficient and effective utilization of the computer becomes a skill, a skill that involves higher level thought processing than many of the traditional methodologies.

A good Computer Utilization Program addresses various needs suggested by The Report to the Secretary of Education by the National Task Force on Educational Technology, The Holmes Group Report, and the Carnegie Report.

The Task Force's Report (1986) recommends that teacher education be one of the six major components in transforming the educational system. The report stated: " successful incorporation of educational technology in the classroom cannot occur without appropriate teacher education." It outlined such strategies as: paid release time, substitutes, off-site training, technology leaders, collaboration with universities, incentives, and increased requirements. It further states " schools should develop the curriculum for the new basic skills required by an information society. It should also include the development of higher-order skills of reasoning and analysis that successful accomplishment of such activities demand."

The Holmes Group suggests that teacher training encompass a fifth year to include teaching related skills. Computer utilization skills would be very appropriate in equipping the prospective teacher with skills to improve their efficiency and effectiveness.

The Carnegie Task Force (1986) suggests that a lead teacher could " provide schools with the technology services, and staff essential to teacher productivity."

Tuckerman and Mandell (1986) state that the concept of a lead teacher includes teachers working with other teachers. Perhaps, a lead teacher could work as a consultant in the proper use of computers, in the areas of specific software packages, and the appropriate infusion of the technology into various curricular areas. They further state " the highly technical nature of the world economy makes it imperative that we produce high school graduates who are better educated than ever before." Teachers will not be educating the students properly without providing experiences of this technical nature.

Starkweather (1986) explains that the International Technology Education Association has actions planned for assisting technology teachers to be instructional leaders in the schools.

Jordan (1986) quotes Dr. Martin Engel, Project Manager of the Apple Classroom of Tomorrow, that computers in the classroom can be a "turn-on" for teachers as well as for

students. Dr. Engel states "they feel they're into something, something's happening here. It's not just boring routine."

Not only are computer utilization skills necessary for teachers, but attention is being given to the need of such skills by administrators. Braun (1987) reported that two study commissions, in their reports to the New Jersey Board of Education, have recommended new licensing standards for principals to include " extensive training in the use of computers" in such areas as instruction, statistics, budgeting, and office automation.

As pointed out by Rodgers et al (1985), the best utilization of the computer is by integrating its use into various areas in the curriculum. Adler (1986) states that " there can be no question that the developing in the minds of our students the ability to think- critically at least, if not also creatively- should be the prime objective of basic schooling. Unless students can be trained to think critically, none of the other objectives of basic K-12 schooling can be achieved." He contends that a program does not need to be developed for that objective, but rather all teachers need to structure their courses to promote critical thinking. Similarly, to use the computer as a tool to foster such higher level thinking processes, computer utilization skills need to be integrated into all areas in the curriculum.

An outline of the skills now needed in this computer age will be suggested as a major component in a good staff development program. This list is presented as a model to be customized according to local needs and resources. A general outline of such computer utilization skills should include :

1. Use of the Computer as a Tool
2. Basic Parts of a Computer System and Their Functionalities.
3. Bits and Bytes and ASCII Code
4. Use of Specific Machine
5. Word Processing
6. Data Bases
7. Data Processing System
8. Spreadsheets
9. Graphics
10. Integration
11. Programming
12. External Data Bases
13. Utilities
14. Classroom Applications
15. Peripheral Technology

[1] The use of the computer as a tool should be stressed at the beginning of such a computer utilization training program. The mystique of the computer should be transformed into an appreciation of the skills needed to make the computer do what the user wants it to do.

[2] A general description of a computer system having four basic parts (input, processor, output, auxiliary storage) is essential. These four functionalities can then be explained in terms of the existing hardware. Examples of other

hardware items such as: a mouse, scanner, joystick, and plotters; should be discussed in terms of their functions.

[3] The concept of how a pre-determined signal, in the form of a byte, is created every time a key is pressed, should be explained. There is no great need for binary arithmetic or an understanding of machine language, just an awareness of the need for signals of on and off switches and how the pressing of different keys create different electrical signals to this piece of machinery. It should be pointed out why the letter "O" and the number "0" are completely different to the computer. The discussion should also explain how the computer puts characters in alphabetical and numerical order. Depending on how a program is written, it is possible that "ZOO" would come alphabetically before "ant" (ZOO is made of ASCII characters 90,79,79 and ant: 97,110,116). Once a basic understanding of bits, bytes, and the ASCII Code is established, the terms "K" and "Meg", and how the user's work space (RAM) and storage is rated in terms of Ks and Megs should be explained.

[4] At this point, the operation of the available hardware, in terms of the functionalities explained in part [2], becomes a part of the learning experience. How to boot up or log on, how to retrieve files, how to save files, the care of disks or use of hard drives, and basic functions in the

operating system can to be detailed.

[5] The use of a word processor should be presented from the perspective of personal typing, not secretarial typing. The educator should learn how to create documents, to save files, to print documents, to edit (inserting, deleting, and block moves), and to format (adjusting margins and page lengths.) The use of a spelling checker should be addressed either by discussion or, if possible, by actual use. Issues such as acceptance of word processing documents by colleagues, proof that it is the student's work without actual handwriting, and plagiarism from data transferred from data base to word processor need to be addressed.

[6] The educator should use an existing data base and be introduced to the search strategy needed to retrieve specific records. Then, the educator should plan and create an actual data base, and discuss how to edit records and why updating is necessary. The educator should learn how to sort data in a data base and generate reports. Emphasis should be given to the generation of different report formats from the same data.

[7] Data processing as a system can now be addressed. The importance of data integrity can be pointed out by the validity of a report being only as good as the accuracy of all the data that it used. Updating information, monitoring

the processes, controlling access, providing security, and needing backups should be explored.

[8] The use of spreadsheets should start with a basic understanding of the concept of rows and columns as a common organizational strategy. Demonstrations of the "what if" capability should easily impress the educator of the utility of such time-saving calculations. Educators should also be exposed to a spreadsheet in the form of a chart without calculations, showing the usefulness of being able to insert new rows and columns.

[9] Exposure to computer graphics should be provided. If possible, either a demonstration or hands-on use of the Macintosh can easily illustrate the creation of diagrams and other illustrations useful in lesson presentations. The quality of teacher created materials can be dramatically improved.

[10] Integration of graphics, spreadsheets, or data base reports into word processing documents should be explored. The creation of form letters and the selection of addresses from a data base should be demonstrated.

[11] Programming should be limited to simple sequential programming involving the input of a number, doing a

calculation involving that value, and producing relevant output. This should also reenforce how computers work, as explained in part [2]. Exposure to programs involving menus, and the resulting loops and decisions should be presented to promote awareness of the mechanics of menu-driven software.

[12] The best way to explain the use of external data bases is to actually demonstrate the use of an external data base such as ERIC, The Source, CompuServe, DIALOG, Dow Jones, etc. Discussions should include what information is available from such data bases and the strategies needed to obtain desired information while minimizing time and cost.

[13] Educators should be exposed to such utilities as PRINT SHOP, Certificate Maker, and grading programs.

[14] Educators should experience a simulation. Discussion of the value of such simulations is helpful in evaluation of their usefulness. A demonstration of music created on a computer should be presented. Examples of computer aided instruction should be provided, with analysis and evaluation.

[15] A demonstration of large screen projection and CD ROM should be provided.

Although these computer utilization skills have been presented in the form of a model, to be customized at the local level, software packages such as: Appleworks (Apple II family), Microsoft Works (Macintosh and PC environment), and First Choice (PC environment); would serve most of the needs very well. The more powerful software created may not be the best. It may be so powerful that it is overwhelming. Simple, menu-driven, easy-to-use software would be most productive.

School Tech News (March 1987) reports that a recent survey of effective programs for inservice training in the use of computers, conducted by Brian Stecher of Educational Testing Service, offers the following tips:

1. Provide enough computers and materials for all participants. During training, this means one computer per teacher.
2. After training, provide access to computers.
3. During training, provide as much "hands-on" time as possible.
4. Make the teachers feel comfortable. This includes atmosphere, lighting, and a trainer with a sense of humor.
5. Make sure the trainer is knowledgeable about the subject.
6. Present the lessons in small segments, with time given to complete tasks.
7. Use school-based staff as trainers when possible.
8. Provide opportunities for the teachers to interact among themselves.
9. Teachers must be taught how to use the computer to best advantage in their particular grades or subjects.
10. Incorporate follow-up contact with the trainees.

The topics included in our model would best be served by 15 to 50 hours of instruction and hands-on time. The amount of time needed would vary according to the amount of hands-on experiences provided. The actual implementation can vary from in-service programs to graduate level courses. We are presently pursuing such a program to be provided as a graduate level course, on site, at a convenient time. School Tech News (April/May 1987) reports that the Rand study goes as far as to say " extra pay could stimulate computer use where none has previously existed, or might deter computer-using teachers from leaving the teaching profession."

New Jersey students take a High School Proficiency Test in 9th grade in mathematics, reading, and writing. Students who fail to meet minimum standards are then required to take remedial courses in those areas, in addition to regular courses. In our district, three different teachers were assigned to the remedial writing classes. One of the three teachers was trained in the use of a word processor and a curriculum developed to take advantage of the use of the word processor as a writing tool. While the two teachers using traditional methodologies were able to raise the writing proficiencies of 70% of their students to the acceptable level, the teacher using the word processor had a 100% success rate. Although this was not a true scientific experiment, the 30% difference seems both significant and supportive to this proposal. Whether it was the computer or

the staff development that made the difference needs no debate, if we accept the proposal that computer utilization skills as a component of staff development will lead to the appropriate use of the computer as a productivity and instructional tool.

In addition to such training, there is a definite need for on-going support services to extend the training into actual implementation and to extent the scope of the use of the computer. This can be accomplished in a number of ways: using technology literate staff as consultants within the district, use of lead teachers to provide necessary support, and use of parental expertise. As the scope of support needs increase, local business and colleges/universities may be able to supply technical support. Without such support, the best of training programs may fail in having teachers infuse the use of the computer in their areas of expertise. As with other tools, the skill of computer utilization needs proper guidance so that the instrument can be of continuous usefulness.

In its call for proposals for their twelfth annual conference, the National Council of States on Inservice Education posed the question : " Teachers and Computers: Friend or Foe ." In our opininon, the answer is an easy one; not only is the computer a friend, it is a necessary ally.

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